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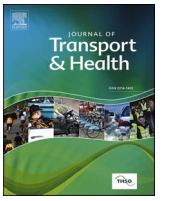

20mph speed limits and zones for better public health: Meta-narrative evidence synthesis☆

Carel-Peter L. van Erpecum [a,*], Anna Bornioli [b], Claire Cleland [c], Sarah Jones [d], Adrian Davis [e,f], Nicolette R. den Braver [g], Paul Pilkington [d]

[a] Erasmus School of Economics, Department of Applied Economics, Rotterdam, the Netherlands
[b] Environmental Psychology Research Group, University of Surrey, United Kingdom
[c] Centre for Public Health, School of Medicine, Dentistry and Biomedical Sciences, Queen's University Belfast, Belfast, United Kingdom
[d] Public Health Wales, Cardiff, United Kingdom
[e] College of Business and Law, University of the West of England Bristol, Bristol, United Kingdom
[f] Transport Research Institute, School of Computing, Engineering & the Built Environment, Edinburgh Napier University, Edinburgh, United Kingdom
[g] Department of Epidemiology and Data Science, Amsterdam University Medical Center, Amsterdam, the Netherlands

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ABSTRACT

Background: Recently, twenty miles per hour (20mph/30kph) speed limit and zone interventions have been increasingly adopted in various European cities. These 20mph speed limits and zones do not only contribute to road safety but they may also be beneficial for public health outcomes such as active travel, physical activity, and air pollution. We aimed to provide an updated assessment of the evidence for potential health effects of 20mph speed limits and zones.

Methods: We searched four electronic databases MEDLINE, EMBASE, Web of Science and Transport Research Information Service and assessed the grey literature through keywords related to '20mph' or '30kph' and health outcomes.

Results: A total of 23 publications (13 academic and ten grey literature publications) were identified. Overall, 20mph speed limits and zones have clear effects on injuries, collisions, and casualties. The wider effects of 20mph speed limits and zones on public health outcomes such as active travel, physical activity, and air pollution need further evaluation. Several subgroup analyses suggested differential effects for age groups, gender, neighbourhood deprivation level, ethnic background, employment status, health status, and type of road user (e.g., cyclist). Additionally, methodological limitations of the evidence base were highlighted, including challenges regarding exposure and outcome measurement and description, and the difficulty of evaluating changes in public health variables over long follow-up periods when using natural experimental methods.

Conclusions: 20mph speed limits and zones have the potential to improve road safety. Whilst the broader public health effects of 20mph remain poorly understood given difficulties in evaluating, the logic path through which 20mph speed limits and zones can benefit public health is clear. Future research should address this gap and consider the broader role that lower speed limits and zones can play in creating healthier cities.

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* Corresponding author. Burgemeester Oudlaan 50, 3062 PA, Rotterdam, the Netherlands.
E-mail address: vanerpecum@ese.eur.nl (C.-P.L. van Erpecum).

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1. Introduction

Twenty miles per hour (20mph) or 30 kilometres per hour (30kph) speed limits and zones are an increasingly common intervention in cities worldwide (Röth, 2022). Importantly, 20mph speed limits represent a 'sign only' intervention without physical changes to the road involved (Cleland et al., 2020). This differs from 20mph zones, that involve physical changes to the road, such as introducing speed bumps and road narrowing designed to self-enforce the lower speed limit. Both 20mph speed limits and zones offer their own advantages: while 20mph zones involve the advantage of being self-enforcing, with physical traffic-calming measures slowing motorised vehicles, 20mph speed limits are cheaper, thereby offering the opportunity to cover a larger geographic area.

The primary reason for introducing 20mph speed limits and zones is to reduce road-traffic collisions and related road traffic-casualties and fatalities. Correspondingly, evidence consistently shows that 20mph *zones* effectively reduce road traffic speed, collisions and associated casualties, while the evidence for these benefits in the case of 20mph speed *limits* is lacking (Cleland et al., 2020). This lack of evidence is partly because 20mph speed limits are increasingly popular and more recently introduced, with various European cities implementing 20mph speed limits at city-wide level over the past few years (Röth, 2022). Hence, there is a need to reassess the evidence on the effects of 20mph speed limits on road-traffic collisions and related road traffic-casualties and fatalities; and for the effects of 20mph limits and zones on other public health outcomes such as the promotion of active travel, the reduction of obesity (through pathways involving physical activity and sedentary behaviour), combating air (Layfield et al., 2003; Webster et al., n. d.) and noise (Pilkington et al., 2018) pollution, lowering carbon emissions (Cleland et al., 2020; Layfield et al., 2003; Webster et al., n. d.), and enhancing livability. In this regard two reviews, published in 2015 and 2020, have summarized evaluations on the effects of 20mph speed limits and zones on public health and social outcomes (Cairns et al., 2015; Cleland et al., 2020). However, both reviews concluded that the evidence base has primarily focused on effects of previously mentioned road traffic-injuries and deaths whereas impacts on these broader public health and social outcomes is unclear (Cleland et al., 2020). Following the publication of these reviews, the evidence base on 20mph speed limits and zones increased significantly due to the increased implementation, wider geographic coverage and the time after implementation increasing, which provides the opportunity for longer follow-up periods.

Therefore, the aim of this review was to update the most recent review by Cleland and colleagues (Cleland et al., 2020) which focused on the effects of 20mph speed limit interventions (as well as zones) on public health and social variables.

2. Materials and methods

2.1. Literature search

Cleland et al. conducted a meta-narrative evidence synthesis of 20mph speed limit interventions and zones to identify a range of public health outcomes (Cleland et al., 2020). Covering the period from 1983 (when the first 20mph zone/limit was introduced) to January 2019, the review by Cleland et al. (2020) sought natural experiments, randomised controlled trials, controlled before and after studies or interrupted time series studies. The current review used the same search strategy and inclusion criteria and covered the period January 2019 to January 2023. One additional paper (Bornioli et al., 2018) was included as this was not covered by the previous review that we aimed to update (Cleland et al., 2020) and was determined to be a key paper for the evidence base. Four electronic databases were searched, including MEDLINE, EMBASE, Web of Science and Transport Research Information Service, as well as the grey literature. Searches used '20mph' or '30kph' AND 'health' as main keywords. Variations of keywords relating to '20mph' or '30kph' were combined using the OR command. Variations of keywords relating to 'health' were also combined using the OR command (Supplementary Table A). COVIDENCE was used to support article screening, with two authors screening each paper for eligibility and any differences were resolved by a third reviewer. Inclusion criteria replicated Cleland et al. (2020) (Cleland et al., 2020) and are reported below:

1. Methodology: Natural experiments containing quasi-experimental design; randomised control trials; controlled before and after studies; and interrupted time series.
2. Setting: no restrictions regarding age group, country, and location.
3. Use of 20mph or 30kph speed 'zones' or 20mph or 30kph speed 'limits' interventions (1 mile equates to 1.6 km).
4. Studies should involve a comparison group.
5. At least one public health or social outcome was reported.

We also conducted a grey literature search in both English and Dutch. Dutch literature was included considering the Netherlands' active policy stance towards cycling-based mobility and car-light environments. Searches were performed using 20's Plenty, The Royal Society for the Prevention of Accidents (RoSPA), UK Roads Liaison Group, and Department of Transport for English language, and a recent publication on 30kph (Koster et al., 2023).

2.2. Data extraction and evidence synthesis

Data extraction and synthesis involved gathering key details from articles, including general information (first author, publication year, journal, Digital Object Identifier (DOI), country and city, outcome types (classified after analysis into driving speed, speeding behaviours, traffic volume, neighbourhood perceptions and liveability, injuries/collisions/casualties, noise exposure, physical

activity)), methodological aspects (study design, control group details, measurement periods, registry dataset, follow-up period, study population, inclusion/exclusion criteria, sample size, intervention details (speed limit prior to intervention, added components such as physical calming measures, education campaign, and level (e.g. street, neighbourhood, city)), and results (main findings, effect sizes, uncertainty measures, p-values, and insights on vulnerable subgroups if applicable). We synthesised these aspects into a narrative review format and presented a synthesis by outcome type.

2.3. Quality appraisal

Additionally, a quality appraisal was performed to assess the following aspects:

- follow-up period (i.e., is it long enough to examine the impacts of the intervention?);
- risk of confounding (i.e., are high-quality controls selected and secondary changes adjusted for?);
- measurement independent variable (i.e., is the intervention described in sufficient detail? Are spill-overs precluded?);
- measurement dependent variable (i.e., validity and reliability of measurement instrument);
- reporting (is reporting of results transparent and are conclusions drawn cautiously?)

3. Results

3.1. Inclusion of studies

The searches found 1899 studies (Fig. 1). After removing duplicates (n = 35), 1864 studies were screened based on title and abstract and 55 studies met eligibility criteria for full-text screening. Ultimately, 13 papers (Anderson et al., 2022; Bornioli et al., 2018, 2020; Brink et al., 2022; Fridman et al., 2020; Hunter et al., 2023; Inada et al., 2019; Isaksson-Hellman and Töreki, 2019; Lawrence et al., 2020; Moulin, 2023; Nightingale et al., 2022; Popov et al., 2021; Williams et al., 2022) were fully reviewed. Ten additional grey literature reports were also fully reviewed and discussed separately in the meta-narrative evidence synthesis (section '3.10 Grey literature').

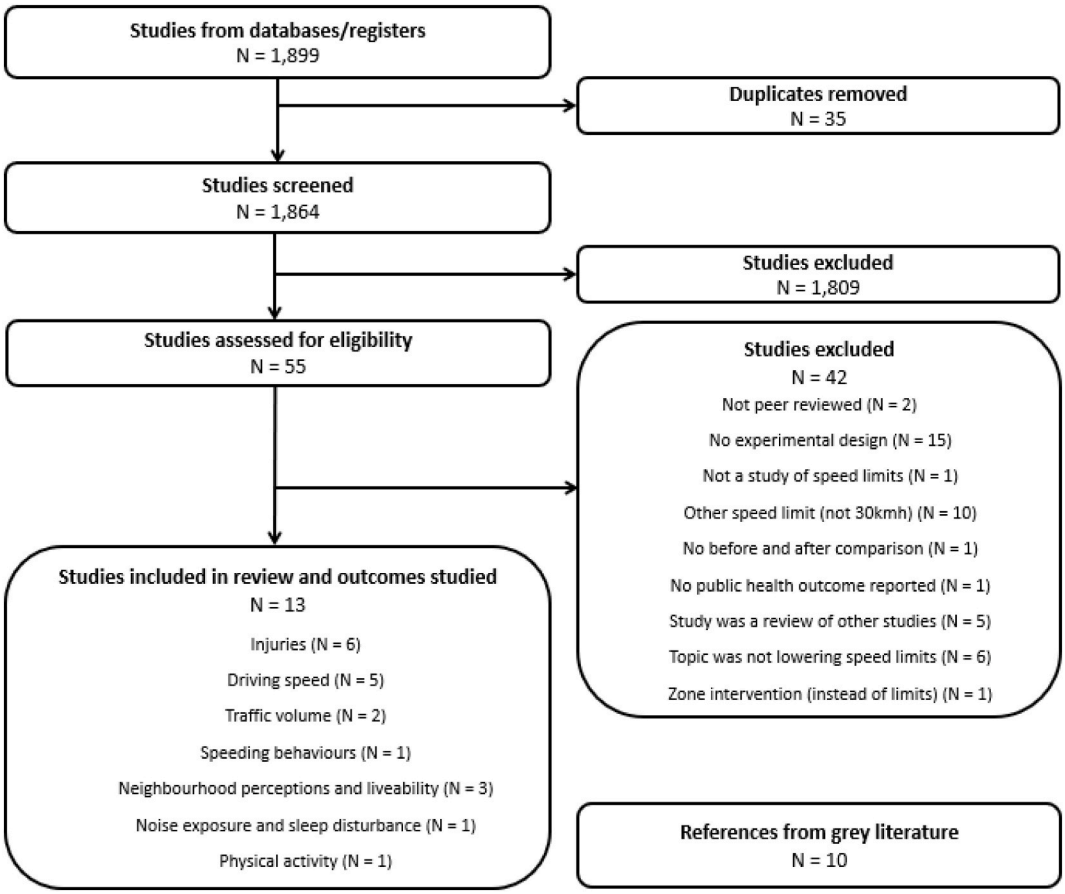

Fig. 1. PRISMA flowchart of included studies (Van Erpecum et al., 2024).

3.2. Study area

The studies were conducted in various locations: Bristol, England (Bornioli et al., 2018, 2020); Paris, Nantes, Rennes, and Lyon, France (Moulin, 2023); Belfast, Northern Ireland (Hunter et al., 2023); Edinburgh, Scotland (Nightingale et al., 2022; Popov et al., 2021; Williams et al., 2022); Zürich, Switzerland (Brink et al., 2022); Portland, USA (Anderson et al., 2022); Toronto, Canada (Fridman et al., 2020); and Melbourne, Australia (Lawrence et al., 2020). The studies in Sweden (Isaksson-Hellman and Töreki, 2019) and Japan (Inada et al., 2019) utilized nationwide data. Except for two studies in 2018 (Bornioli et al., 2018) and 2019 (Isaksson-Hellman and Töreki, 2019), all others were published between 2020 and 2023.

3.3. Outcomes

The most common outcomes were collisions or casualties (N = 6) (Bornioli et al., 2020; Fridman et al., 2020; Hunter et al., 2023; Inada et al., 2019; Isaksson-Hellman and Töreki, 2019; Popov et al., 2021) and driving speed (N = 5) (Anderson et al., 2022; Bornioli et al., 2018; Hunter et al., 2023; Lawrence et al., 2020; Nightingale et al., 2022) (Supplementary Table B). Traffic volume was explored in two studies (Hunter et al., 2023; Nightingale et al., 2022), while one study investigated 20mph speed limits in relation to speeding behaviours (N = 1) (Anderson et al., 2022). Less-explored outcomes included neighbourhood perceptions and liveability (N = 4), noise exposure and sleep disturbance (N = 1) (Brink et al., 2022), and physical activity (N = 1) (Moulin, 2023).

3.4. Design and control groups

A complete overview of the characteristics of the study design of each study is shown in Supplementary Table C. Eleven out of 13 studies used a before-after design, and one of these eleven studies employed a stepped-wedge approach (Bornioli et al., 2018). Another employed a 'quasi stepped-wedge design' (i.e., stepped wedge design where pre-intervention data are lacking). A repeated cross-sectional design was used in one study (Williams et al., 2022).

Control groups were present in six studies (Lawrence et al., 2020), while seven studies lacked a control group. Control groups were adjacent districts with unchanged speed limits (n=2) (Fridman et al., 2020; Hunter et al., 2023); another city without a switch to 30kph (n = 1) (Moulin, 2023); unchanged arterial roads (N = 1) (Inada et al., 2019); a combination of 41 different areas (N = 1) (Lawrence et al., 2020) and intervention sites to be changed at a later stage (n = 2) (Bornioli et al., 2018, 2020). One study utilized multiple control groups (Hunter et al., 2023), including, (1) a part of the city centre with no speed limit changes; (2) surrounding metropolitan area; and (3) matched control area based on urbanicity, area deprivation, and population density. The measurement periods varied between 1996 and 2020, and follow-up length varied greatly (1–9 years).

3.5. Intervention description

Eleven studies reported city-wide interventions, including one involving multiple cities (Moulin, 2023). Two studies focused on nationwide interventions (Inada et al., 2019; Isaksson-Hellman and Töreki, 2019), with the study of Inada et al. specifically targeting local roads with a nationwide 30kph speed limit policy. Six out of 13 studies did not report previous speed limits, and when reported, they ranged from 40kph to 60kph. Additionally, some studies noted extra measures alongside the speed limit change. Seven studies included an education campaign (Anderson et al., 2022; Bornioli et al., 2018, 2020; Hunter et al., 2023; Nightingale et al., 2022; Popov et al., 2021; Williams et al., 2022), three mentioned enforcement (Nightingale et al., 2022; Popov et al., 2021; Williams et al., 2022), and two cities implemented physical calming measures in a limited street proportion (Brink et al., 2022; Inada et al., 2019).

3.6. Outcome measurement

Driving speed, speeding behaviours, and traffic volume data were sourced from Google Maps, routinely collected data, and company datasets (e.g., Tracsis). Based on these data, variables such as mean speed, 85th percentile speed, median speed, and speed exceeding limits were computed. Injury studies relied on police data, except for a Swedish evaluation using third-party insurance claims data (Isaksson-Hellman and Töreki, 2019) to assess pedestrian-motor vehicle collisions and severity.

Neighbourhood perceptions and liveability data came from surveys (Lawrence et al., 2020), including the Speed Limits Perception Survey (Williams et al., 2022). Physical activity was measured by bicycles count recorders at selected sites (Moulin, 2023). Noise and sleep disturbance were assessed through questionnaires (ICBEN scale), noise pollution models, and traffic reports from the local transport department (Brink et al., 2022).

The type of statistical analysis used was heterogeneous and included: difference-in-differences models (Moulin, 2023); repeated measures Poisson regression (Fridman et al., 2020; Hunter et al., 2023); interrupted time-series models (Inada et al., 2019); generalized mixed, linear, or additive models (Bornioli et al., 2018; Nightingale et al., 2022; Popov et al., 2021); negative binomial regression (Bornioli et al., 2020); Hidden Markov analyses (Popov et al., 2021); and log-linear regression (Anderson et al., 2022). Inferential tests included paired t-tests (Brink et al., 2022; Nightingale et al., 2022), Chi-Square test (Williams et al., 2022), Mann-Whitney U test (Williams et al., 2022) and Kruskal Wallis tests (Williams et al., 2022). Isaksson-Hellman et al.'s (Isaksson-Hellman and Töreki, 2019) study focused solely on descriptive changes.

3.7. Quality appraisal

Studies generally described interventions, including level of intervention (e.g., city-wide), but seven studies did not report the speed limit before intervention. Some studies lacked clarity on intervention components (e.g., education campaign, enforcement, use of physical calming measures). Most studies did not use controls or chose areas adjacent to intervention, potentially introducing spill-over effects (Bornioli et al., 2018). A positive exception here was the study of Hunter et al. (2023): with three different control groups (adjacent area, metropolitan area farther away, and area matched on area-level characteristics). Some studies adjusted for covariates such as time and seasonality to minimize confounding, while others did not include any covariates.

Follow-up periods typically ranged from one to three years, with only two studies reporting outcome measure properties. Validity and/or reliability of outcome measures were rarely reported with two exceptions ((Brink et al., 2022; Williams et al., 2022)).

Statistical analyses varied widely and typically did not consider clustered data and time-invariant covariates by for example fixed effects analyses, even though this could have an added value in the case the 20mph interventions are not distributed 'randomly' across areas.

The risk of reporting bias was generally low: all studies transparently reported results and provided a cautious conclusion based on these results, except for one study that mentioned certain findings in the discussion section without mentioning these in the results section (Lawrence et al., 2020).

3.8. Main findings

3.8.1. Speed and speeding behaviours

In Melbourne the treated area had a slight mean speed reduction over 12 months (−1.1%), but in the same period the control region also saw a decrease (−2.7%) (Lawrence et al., 2020). Odds of vehicles exceeding 40kph and 50kph significantly decreased for the treatment areas as compared to the control (40 kph: OR = 0.89, 95% CI 0.87, 0.92; 50 kph: OR = 0.75, 95% CI 0.67, 0.84). In Bristol, an adjusted speed reduction of 2.7mph was observed over 2–3 years, with the greatest reductions during the day, during weekends, and in summer (Bornioli et al., 2018).

In Belfast a small median speed reduction was observed on intervention roads after one (0.2mph, 95% CI −0.3 to 2.4, $p = 0.14$) and three years (0.8mph, 95% CI −1.5 to 2.5, $p = 0.17$) (Hunter et al., 2023). Edinburgh's 20mph speed limit was associated with significant mean and median speed reductions of 1.3mph and 0.5mph, respectively, after 12 months (Nightingale et al., 2022). Speed reductions were greater on main streets compared to residential streets. Portland experienced decreases in speeds above 25mph, 30mph, and 35mph after adjustments (0.5%, 1.7%, and 0.5%, respectively) (Anderson et al., 2022).

3.8.2. Traffic volumes

In Belfast (Hunter et al., 2023), after one year, traffic volumes decreased by 57 vehicles per week (95% CI –162 to −14, $p < 0.01$) compared to matched streets, and by 71 vehicles per week (95% CI −213 to 1, $p = 0.05$) after three years. In Edinburgh, there was a non-significant weekly reduction of 86 vehicles (2.4%) (Nightingale et al., 2022).

3.8.3. Injuries, collisions and/or casualties

Four out of six studies reported a reduction in injuries, fatalities, or casualty rates. In Toronto (Fridman et al., 2020), pedestrian-vehicle collisions decreased by 28% in 30kph (instead of 40kph) intervention streets compared to 7% in adjacent areas. This is large enough to be of practical importance but the study was too small for it to achieve conventional statistical significance. Bristol (Bornioli et al., 2020) showed a significant reduction in fatal, serious, and slight injuries on 20mph intervention roads as well as across the entire city. In Japan (Inada et al., 2019), implementing nationwide 30kph speed limits and zones was associated with significantly lower cyclist and pedestrian deaths and serious injuries, potentially preventing up to 1704 deaths between 2011 and 2016. In Belfast, no difference in collisions but a trend in reduced casualties (−22%, $p = 0.06$) was observed between intervention and control over three years (Hunter et al., 2023). In Sweden, a nationwide 30kph policy reduced the risk of moderate to fatal injuries among injured cyclists by 25% over a follow-up period up to nine years (Isaksson-Hellman and Töreki, 2019).

3.8.4. Noise exposure and sleep disturbance

Brink et al. (2022) observed a significant decrease in objective noise exposure and self-reported sleep disturbance after lower speed limits and zones were implemented (Brink et al., 2022).

3.8.5. Physical activity

The French study assessed bicycle commuting before implementation of 30kph limits, finding no significant effects (Moulin, 2023). However, it should be noted that the follow-up of one year was relatively short, and that the validity of the outcome measurements were unclear.

3.8.6. Neighbourhood perceptions and liveability

Williams et al. (2022) found that the introduction of 20mph speed limits were associated with improved neighbourhood perceptions (Williams et al., 2022). Brink et al. (2022) observed an increased self-reported road safety after lower speed limits and zones were implemented (Brink et al., 2022).

3.9. Subgroup analyses

Several studies conducted analyses on the impact of 20mph/30kph speed limits across different subgroups. The study in Toronto (Fridman et al., 2020) found that adults (16–59 years) and children (0–15 years) benefitted more from lower speed limits in terms of collision reduction than older adults (60+ years). Hunter et al. (2023) discovered relatively large reductions in collisions and casualties among females and older adults (65+ years) in a three-year follow-up. In Japan (Inada et al., 2019), boys aged 0–14 years benefited the most from 30kph limits and zones in terms of fatal and serious injuries.

Williams et al. (2022) found varied impacts of 20mph speed limits on neighbourhood perceptions across neighbourhood deprivation level, sex, ethnic minority, work status, disability, and type of road user (e.g., cyclist, motorcyclist, car user, or pedestrian) (Williams et al., 2022). However, Hunter et al. (2023) found no consistent evidence for different benefits among various types of road users (Hunter et al., 2023).

3.10. Grey literature

Seven grey literature reports were found. Beek examined how lower speed limits could affect job accessibility by car and bicycle in Amsterdam and concluded that lower speed limits reduce job accessibility for most car users while accessibility would increase for cyclists (Beek, 2022). Regarding casualties, a New York City study suggested that a 25mph (instead of 30mph) speed limit reduced fatal crashes by 62% (Zhai et al., 2022). Swiss research (Zhai et al., 2022) observed decreased collision injury severity after introducing 30kph. A Scottish study (Olowosegun et al., 2023) noted a lower mean speed after implementing a 20mph speed limit. An interview study found that Scottish police officers thought that 20mph speed limits would reduce casualty numbers and casualty severity, especially with intensive road traffic policing (Davis, 2019). A study from Wales (Toy, 2022) proposed several behavioural interventions for driver compliance with a 20mph speed limit. Furthermore, Jepson et al.'s (2022) report summarized research on 20mph speed limits in Edinburgh and Belfast with novel results from evaluations across these cities that were not published in the scientific peer-reviewed literature. These authors noted improved liveability in both cities and a substantial decrease in casualty rates in Edinburgh (−39%) following 20mph speed limits. Also, effects of 20mph speed limits differed across age group and user type, although a consistent moderation pattern across these subgroups was not found.

The Behavioural Insights Group Rotterdam (BIGR) report from the Netherlands (Merkelbach et al., 2023) recommended a combination of measures for effective behavioural adherence to 30kph speed limits, including: (1) explain to residents that the majority of people support 30kph/20mph; (2) use famous individuals as role models; (3) emphasize the advantages for the neighbourhood; (4) thank individuals for showing the desired behaviour (e.g., driving slowly); (5) time communication well and in the right locations; (6) capitalise on loss aversion and potential fines; (7) influence speed perception by road changes; (8) communicate safety improvements as an advantage of 30kph; (9) use tailored approaches rather than just generic city-wide campaigns. In line with this notion Röth (2022) emphasized the inclusion of a combination of measures to ensure adherence to 30kph speed limits (Röth, 2022). This also aligns with another study suggesting physical changes, separate bicycle lanes, and 'woonerf' settings for enhanced cycling behaviour (Pucher and Buehler, 2008).

4. Discussion

4.1. Assessment of the published literature

Altogether, studies suggest a connection between 20mph (30kph) speed limits and zones and modest reductions in car speed, traffic volume, injuries, collisions, and casualties. There is no consistent evidence indicating variations in these impacts across age groups and gender. Additional research supports associations between 30kph zones and reduced noise exposure and sleep disturbance. However, no evidence was found regarding impacts on physical activity.

Consistent with Cleland et al., 's 2020 evidence synthesis (Cleland et al., 2020), impacts on injuries, collisions, and casualties were observed. However, there is limited evidence on broader health effects such as changes in active travel, play, air quality, or knowledge and attitudes. Investigating these broader impacts is challenging due to the difficulties in measuring and assessing data not routinely collected in registries, unlike traffic injuries. Furthermore, studying these broader impacts requires longer timescales than have been used in studies to date as these broader health variables typically change slowly over time. Nonetheless, understanding these impacts is crucial, especially amid the urgent need to shift towards alternative forms of mobility. Encouraging people to travel less by car and more by public transport, bicycle, or walking could yield significant public health benefits, addressing issues such as obesity (Frank, 2022; Papas et al., 2007) and contributing to combating the climate crisis (Nieuwenhuijsen and Khreis, 2016). However, and importantly, reviewed studies generally cited the logical pathway from changing the speed limit to these outcomes and none reported any evidence of negative health outcomes.

Whereas the previous review (Cleland et al., 2020) concluded that more evidence is available on 20mph zones than 20mph limits, the current review identified new evidence on 20mph speed limits. Further, small speed reductions appeared as a crucial factor. This is important as any potential effect of lower speed limits on health is theorized to be mediated through speed (Turner et al., 2018). Furthermore, small speed reductions across large areas could potentially have substantial health effects, considering the large number of individuals affected by these environmental modifications. This review also adds insights on moderators in the association between 20mph speed limits and zones and health. No consistent evidence among various studies was found regarding age and gender as potential moderators when examining effects on injuries, collisions, and casualties. Additionally, a new study suggests that effects of

20mph speed limits on neighbourhood perceptions depend on factors such as deprivation level, sex, ethnic minority status, work status, disability, and type of user (e.g., cyclist, motorcyclist, car user, or pedestrian) (Williams et al., 2022).

In this meta-narrative evidence synthesis, the quality assessment highlights both strengths and weaknesses in the evidence base. Strengths include a low risk of reporting bias and explicit reporting of intervention level (e.g., city-wide). However, seven studies did not report on the speed limit prior to intervention, which is crucial for assessing the impact of the intervention. Some studies did not specify if physical calming measures, education, and enforcement were part of the intervention. Furthermore, most studies lacked a control group or used adjacent areas as control group, posing risks of confounding and spill-over effects (Bornioli et al., 2018). Additionally, follow-up periods were relatively short, which is especially problematic for health behaviour studies as health behaviours typically change slowly over several years (Prochaska and Velicer, 1997). Most studies did not describe the validity and reliability of outcome data. Statistical analyses typically did not account for clustered data and time-invariant covariates, neglecting potential benefits of multilevel models or fixed effects analyses.

4.2. Strengths and weaknesses of review

This study's strengths lie in its systematic approach, building on a comprehensive review (Cleland et al., 2020), and its comprehensive assessment of English and Dutch grey literature. However, limitations include potential omission of scientific studies in languages other than English and Dutch, and those non-publicly available within the grey literature. Also, we predominantly feature studies with short-term (<3 years), routinely collected outcome data. This may be problematic, particularly when studying changes in health behaviours that evolve slowly over many years (Prochaska and Velicer, 1997). Moreover, the inclusion of a small number of qualitative studies and the narrative evidence format introduces uncertainties similar to the previous review (Cleland et al., 2020). The heterogeneous reporting styles and study designs hindered a conventional systematic review, and, similarly to the earlier review, we cannot rule out publication bias.

4.3. Implications

Our results support implementing 20mph speed limits and zones due to their impacts on traffic speeds, road collisions, and related injuries and deaths. However, there are areas for development in the evidence base, specifically methodological quality and paying attention to broader outcomes such as active travel and physical activity, air quality, social interactions, and well-being. Acknowledging the potential contributions to shared agendas, including injury prevention, sustainability, air pollution reduction, and promoting environments conductive to physical activity and reducing obesity, should drive a wide array of researchers and policymakers to pursue evidence for these broader outcomes.

Regarding methodology, conducting randomized controlled trials for 20mph speed limits and zones is challenging as 20mph speed limits and zones are typically not amenable to experimental implementation. Natural experiments and advanced designs like the stepped-wedged approach, as seen in Bristol's evaluation (Bornioli et al., 2018), represent viable alternatives. Collaboration between researchers and policymakers is crucial to identify and leverage opportunities for such alternative methodologies. Innovative data collection methods, such as in-car monitoring, can also aid evaluation in this respect, yet other approaches are likely necessary for monitoring broader outcomes. Qualitative research on knowledge, attitudes, and perceptions related to 20mph speed limits and zones is also needed in future studies (Williams et al., 2022). Additionally, subgroup analyses, using quantitative, qualitative, and mixed methods perspectives, can explore differential impacts on various population segments, providing insights into equity issues associated with 20mph speed limits and zones. More specifically, factors such as age, sex, socio-economic status, ethnicity, and residence type could be investigated as moderators. Finally, more research is needed on what elements of 20mph speed limits and zones are most effective in achieving health benefits. 20mph speed limits are usually not implemented as a single intervention, but as part of a broader package with complementary measures such as traffic calming, school streets, education and communication, and enforcement.

4.4. Conclusions

This review reveals significant effects of 20mph (30kph) speed limits and zones on motorised vehicle speed and volume and traffic safety. We note that much of the more recent evidence addresses speed limits rather than zones and that this is related both to relative cheapness of installing limits to zones and to a growing body of evidence indicating effectiveness of 20mph speed limits in at least reducing speeds driven. However, this paper underscores a lack of evidence regarding broader health impacts such as physical activity and modal shift, yet absence of evidence does not equal evidence of absence: possibly, with more rigorous scientific evidence, the broader health impacts of 20mph may be examined. Only then can the potential of 20mph speed limits and zones in fostering healthier, more inclusive, and sustainable living environments be elucidated.

CRediT authorship contribution statement

Carel-Peter L. van Erpecum: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Anna Bornioli:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Claire Cleland:** Writing – review & editing, Methodology, Formal analysis, Conceptualization. **Sarah Jones:** Writing – review & editing, Methodology, Formal analysis, Conceptualization. **Adrian Davis:** Writing – review & editing, Methodology, Formal analysis, Conceptualization. **Nicolette R. den Braver:** Writing – review & editing, Methodology, Formal analysis, Conceptualization.

Paul Pilkington: Writing – review & editing, Methodology, Formal analysis, Conceptualization.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatGPT in order to reduce word count. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jth.2024.101917.

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